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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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08/902,133 07/29/97 FORBES

L 303.356US1

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MM91/0328

EXAMINER

ECKERT II, G

ART UNIT

PAPER NUMBER

2815

DATE MAILED:

20
03/28/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
08/902,133

Applicant(s)
Forbes et al.

Examiner
George C. Eckert II

Group Art Unit
2815



☒ Responsive to communication(s) filed on Jul 2, 1999

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1-16, 18-20, 28, 29, and 32-72 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1-6, 8-16, 19, 20, 28, 29, 32-37, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, ^{63, 65, 67, 69, 71, 72.} is/are rejected.

☒ Claim(s) 7, 18, 38-42, 44-48, 50, 52-54, 56, 58-60, 62, 64, and 66-70 is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s) 1, 16, 18, 1 ^{14, 16, 18, 19}

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Continued Prosecution Application

1. The request filed on July 7, 1999 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 08/902,133 is acceptable and a CPA has been established. An action on the CPA follows.

Response to Amendment

2. Applicant's amendment dated March 14, 2000, in which claims 18, 19, 29, 32 and 39 were amended and claims 41-72 newly added, has been placed of record in the file. Claims 1-16, 18-20, 28, 29 and 32-72 are now pending.

Claim Objections

3. Claim 29 is objected to because of the following informalities: on line 3, replace "a storage electrode" with --the storage electrode--. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 19, 28, 29, 32, 43, 45, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69 and 72 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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These independent claims all include the limitation that "the intergate dielectric has a permittivity that is higher than a permittivity of silicon dioxide." The sole support for that limitation was found on page 16, line 15. It is not sufficiently clear from the claim, nor from the claim in light of the specification, what Applicant considers to be the limits of the invention.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-6, 8, 9 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by the article *Amorphous silicon/amorphous silicon carbide heterojunctions applied to memory device structures*, Sakata et al., Electronics Letters, Vol. 30, No. 9, pp. 688-89, April 1994, (hereinafter Sakata). Sakata teaches a device comprising:

a storage electrode to store charge, formed of amorphous hydrogenated silicon;

a control electrode formed of a metal and separated from the amorphous silicon storage electrode by an intergate dielectric comprised of amorphous hydrogenated silicon carbide. Sakata also teaches that the amorphous silicon carbide has a permittivity (or dielectric constant) of 8 (see Sakata col. 2, at *Results and discussion*) which is higher than the permittivity of silicon dioxide which is 3.9. With regard to claims 1, 2, 6 and 8, Sakata further teach an insulator of graded

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amorphous hydrogenated silicon carbide adjacent to the storage electrode of amorphous silicon. As taught by Applicant, the inherent electron affinity of silicon is 4.2 eV and that of silicon carbide is 3.24 eV (being greater than silicon dioxide at 0.9 eV) such that the barrier energy is $4.2 - 3.24$ or 0.96 eV. With regard to claims 3-5, the limitations of these claims are related to the manner in which the structure of claims 1 and 2 is used or an inherent characteristic of that structure and they do not add further structural limitations to that already claimed. Therefore they are rejected under Sakata. With regard to claim 9, Sakata teaches that the storage electrode formed of amorphous hydrogenated silicon is isolated from conductors and semiconductors as it is formed as a layer sandwiched between layers of amorphous silicon-carbide.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 10-16, 20, 28, 32-37, 43, 49, 51, 55, 57, 61, 63, 65, 71 and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakata in view of Japanese publication 8-255878 to Sugita et al. Sakata has taught the limitations of claim 29 as discussed above but has not expressly disclosed the device having a source region, a drain region or a channel region. However, such limitations are considered obvious in light of that known in the art. Such a device

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including an insulator formed over a substrate in which a source, drain and channel region therebetween are formed, a floating gate over the insulator, a intergate dielectric over the floating gate, and a control gate over the intergate dielectric is well known in the art as an EPROM device. For example, Sugita et al. teaches such a device in their abstract figure. Such a device has widespread application in the art. Given the advantages of the memory device taught by Sakata, for example that device leakage current is low, and the motivation provided by Sakata that the structure may be used in a floating gate memory device, it would have been obvious to form the device of Sakata having source, drain and channel regions such as those known in the industry and taught by Sugita et al.

Allowable Subject Matter

7. Claims 7, 18, 38-42, 44-48, 50, 52-54, 56, 58-60, 62, 64 and 66-70 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: The prior art fails to teach, disclose, or suggest, either alone or in combination, a memory device wherein a storage electrode is formed above an insulator layer such that the barrier energy therebetween is less than approximately 3.3 eV and wherein the storage electrode has an electron affinity smaller than that of polycrystalline silicon, as instantly taught and claimed by Applicant. Nor did the prior art teach a memory device in which the capacitor formed between a floating gate and a

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gate and a control gate had a larger area than did the capacitor formed between the floating gate and a channel region, as instantly taught and claimed by Applicant.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (703) 305-2752.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Mahshid Saadat, can be reached on (703) 308-4915. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

GCE
March 27, 2000


**DAVID HARDY
PRIMARY EXAMINER**